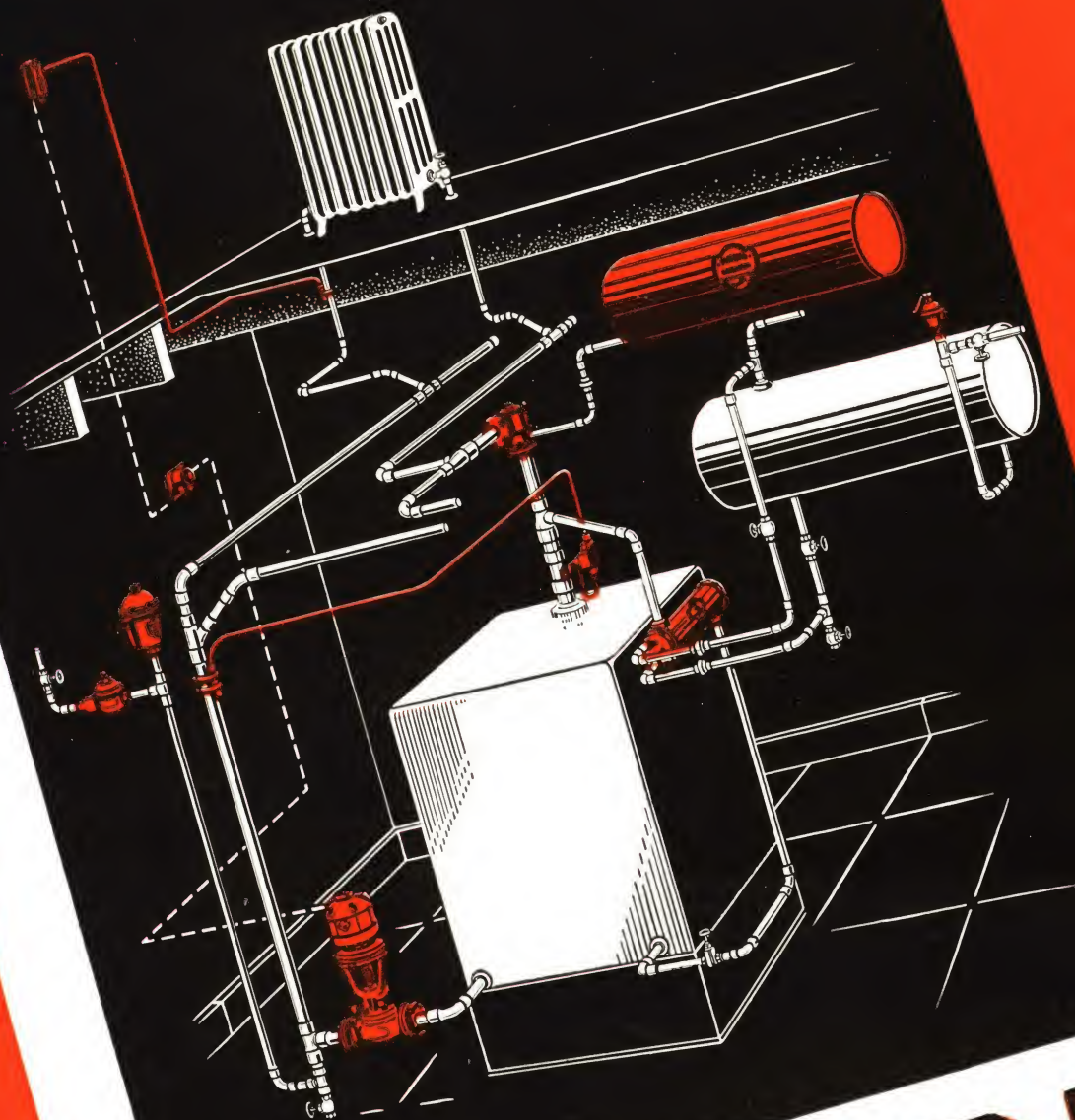




THRUSH

FLOW *Control*
FOR AUTOMATICALLY FIRED
HOT WATER HEAT



..... FLOW CONTROL SYSTEM FOR

26
43

THE COMPLETE SYSTEM

The complete Thrush Flow Control System consists of a Thrush Water Circulator, a Thrush Flow Control Valve, a No. 201 Thrush Radiant Heat Control (thermostat), a No. 203 Modulating Water Temperature Control, a No. 198 Relay Transformer, a No. 12 Thrush Pressure Reducing Valve, a No. 4 Thrush Differential Pressure Relief Valve, a special air-tight Pressure Tank, a Thrush Water Heater and Thrush Combination Gauge and Thermometer.

The Thrush System is a closed pressure system with automatic filling of the boiler, automatic relief of excess pressures, adequate provision for expansion when the water is heating and complete mechanical control of circulation.

When this system is used the heating plant becomes completely automatic, flexible and quick to respond to the slightest need for heat.

Makes Hot Water Heating Quick Heating—There is no overheating and fuel waste when the Thrush Flow Control System is installed. It makes hot water heating "quick heating"—quicker than steam heating.

Thrush Flow Control System of Hot Water Heating assures a continuous flow of radiant heat, reduces fuel consumption, and provides domestic hot water for bath, kitchen and laundry the year around. A reservoir of hot water is kept available for distribution when heat is needed. The No. 201 Thrush Radiant Heat Control automatically controls circulation of water in the

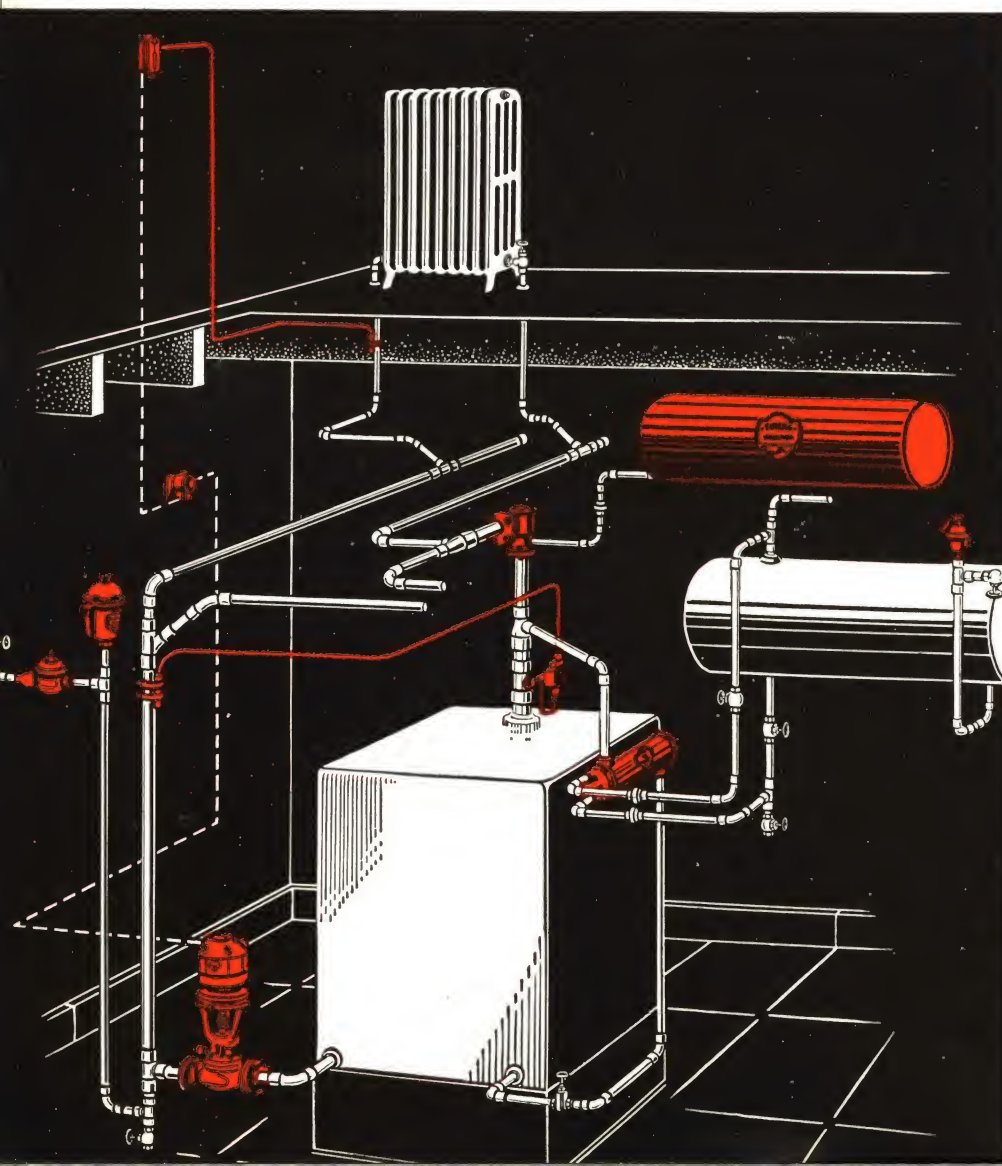
system by starting and stopping the Thrush Water Circulator, which quickly forces water through the Thrush Flow Control Valve into every radiator in every room. Room temperature is maintained within a fraction of a degree.

Entirely Automatic—Thrush Flow Control System is entirely automatic for summer-winter use. Nothing at all need be done to the job for summer operation. The patented Thrush Flow Control Valve shuts off all circulation through the building when heat is not needed but if heat is needed on an occasional chilly morning, Thrush System will provide it without a thought on the part of the tenant.

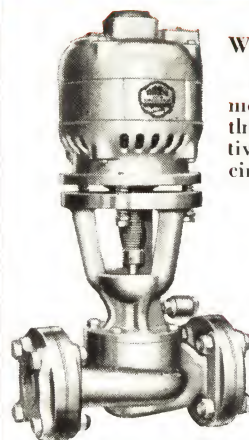
No matter what type of automatic firing device is used with a hot water job, Thrush Flow Control System will increase its efficiency and economy and give it a chance to really demonstrate its advantages.

Thrush Flow Control maintains absolutely uniform temperatures by No. 201 Thrush Radiant Heat Control anticipating outside weather changes. It reduces the running time of the firing device, saves 15 to 30 per cent of the yearly fuel bill and supplies hot domestic water service at nominal cost.

Can Be Quickly Installed—Every automatically fired hot water heating plant should be equipped with Thrush Flow Control System. It can be installed quickly and economically on old or new heating plants. The saving in cost of smaller pipe and valves made possible by the use of this system on a new installation offsets the cost of Thrush equipment.



A BRIEF DESCRIPTION OF

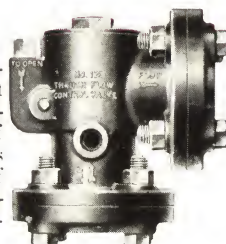


Water Circulator

A silent, electric motor driven unit that assures positive, uniform, forced circulation.

Flow Control Valve

A dependable all-year-round unit that prevents overheating and waste of fuel. It provides complete control of circulation, without any supervision.



Pressure Relief Valve

A dependable automatic Relief Valve that safely protects the hot water heating system from excessive pressure.

AUTOMATICALLY FIRED HOT WATER HEAT

—AND YOU GET THESE 10 ADVANTAGES

- 1. Easy Installation**—Thrush Flow Control System is very easy and inexpensive to install. Refer to the diagrams—count the number, kind and cost of fittings—and you will be surprised at the extreme simplicity of Thrush.
- 2. Less Labor Costs**—The labor cost of installing a Thrush System is surprisingly low. There are no large pipes to cut and thread.
- 3. Economical—Fuel Saving**—Thrush Flow Control saves fuel by reducing the running time of the firing device and eliminating the fuel and the cost of equipment otherwise required for domestic hot water.
- 4. Complete—Balanced**—Thrush Flow Control System of Automatic Hot Water Heating is a complete, balanced, forced circulating pressure system with completely automatic flow control scientifically engineered—developed through years of practical experience and continuous use.
- 5. Automatic Operation**—The operation of this system is fully automatic. It maintains uniform temperature without thought of the home owner from the beginning of the year to the end.
- 6. Forced Throughout**—Forced circulation puts hot water into

every radiator—in every room, quickly. Circulation is stopped when room temperature is recovered so that there is no over-heating.

7. Zone Control—Thrush Flow Control System is ideal where zone control is required. It is simply a matter of installing two or more Flow Control Valves, Circulators and Radiant Heat Controls.

8. Summer-Winter Hook-ups—Thrush Flow Control is ideal for summer-winter hook-up because nothing whatever need be done to the system at any time. It will automatically provide heat in the home when heat is needed but in summer when heat is not desired in the radiators, none reaches them. Yet the automatic firing device continues to supply domestic hot water without interruption.

9. Permits Reduced Pipe Sizes—Thrush Flow Control System permits the use of greatly reduced pipe sizes and requires smaller valves and fittings.

10. Company Responsibility—H. A. THRUSH & COMPANY takes full responsibility for the satisfactory operation of a Thrush Flow Control System installed according to instructions—and its reputation and integrity makes that acceptance of responsibility valid.

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THE UNITS OF THE STANDARD THRUSH FLOW CONTROL SYSTEM

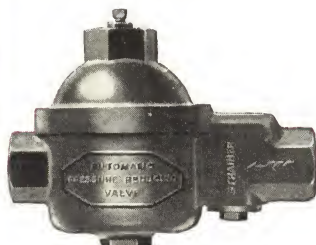


Pressure Tank

Thrush tanks are absolutely air tight, tested under pressure and fully guaranteed. Adds to safety of installation and makes it more efficient.

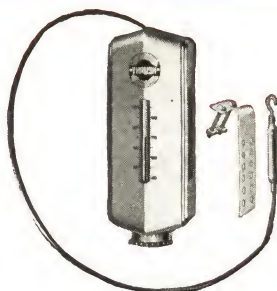
Pressure Reducing Valve

This valve provides automatic filling of the system and assures maintenance of proper water supply in the system at all times.



Water Heater

The straight tube Thrush Water Heater operates at less cost than other automatic sources of hot water. There need be no "conserving" of hot water for laundry, kitchen and bath.

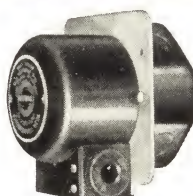
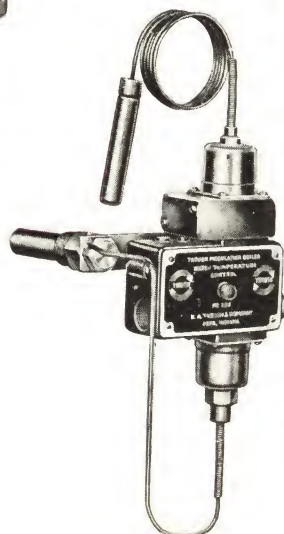


Radiant Heat Control

Automatically maintains room temperature within a fraction of a degree. It controls both room temperature and water temperature in the radiators, compensating to prevent heat variation in rooms.

Relay Transformer

A simple, compact, self-contained unit to be used with the low voltage Radiant Heat Control. It provides line voltage current to the Thrush Water Circulator.



Modulating Water Temperature Control

Automatically raises or lowers boiler water temperature to meet demands. It also maintains any desired minimum temperature to provide domestic hot water.



Gauge and Thermometer

Indicates pressure, altitude and temperature of water in a hot water heating system.

No. 75 Relief Valve

Is used to safely protect hot water storage tank and plumbing fixtures from excess pressure.

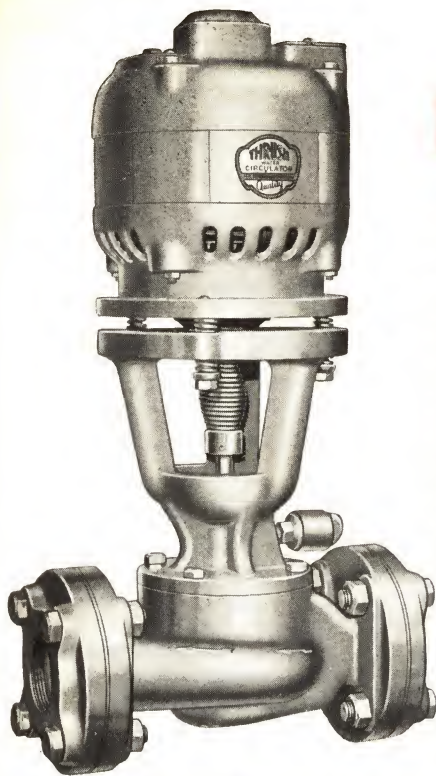


Orifice Inserts

Used to balance circulation through radiators in old, big pipe conversion jobs to assure uniform heat in every radiator. Available in 6 standard sizes.

Description

THAT MAKE THRUSH



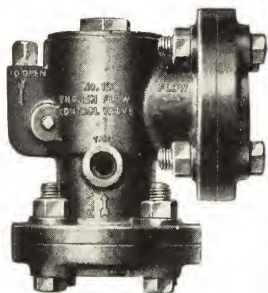
WATER CIRCULATOR

The Thrush Water Circulator is a noiseless, electric motor operated water circulating pump designed and used for three distinct purposes. For Flow Control Systems, the Thrush Water Circulator used in conjunction with a Thrush Flow Control Valve provides perfect circulation control. With a Thrush Tank-in-Basement System, this Circulator, by providing forced circulation, increases heating efficiency and overcomes sluggish circulation and other heating troubles. For use with a Domestic Water Supply System, the

Circulator assures an ample supply of really hot water at every faucet. Greatly increases heat exchanger efficiencies.

Smaller Pipes Are Practical—The Thrush Water Circulator assures quicker heating on any Hot Water Heating System, because mechanical circulation distributes heat units throughout the plant much more rapidly than thermal circulation ever can do it. Therefore it is possible, on new jobs, to reduce pipe sizes which reduces labor and material costs enough to completely offset the cost of the Circulator.

Low Operating Cost—Thrush Water Circulators are correctly designed to lift the load of cold returns, and assure instantaneous heat delivery. They are sturdily built, durable and highly efficient, with quiet motors and flexibly connected, stainless steel drive shafts. They use a very small amount of electric current.



FLOW CONTROL VALVE

It has an opening below the seat that provides for expansion and elimination of air and gases into Thrush Pressure Tank. Manually operated set screw permits opening permanently but is NOT necessary for normal operation. Thus it assures ample expansion for water in the system without permitting any heat to get into

the radiators when it is not wanted. As air and gases are liberated from water in the boiler they are diverted into the pressure tank instead of to the radiators. Only one valve is required that makes the entire function simple and practical.

The patented Thrush Flow Control Valve is made in 6 sizes ranging from 1 in. to 3 in. nominal pipe diameters.

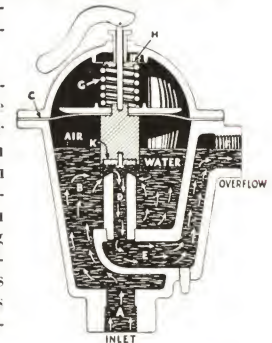


PRESSURE RELIEF VALVE

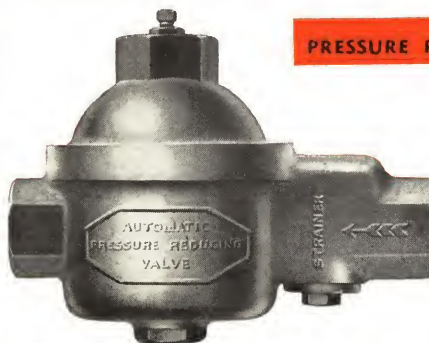
The No. 4 Thrush Differential Pressure Relief Valve is positive in action and dependable in operation. It has a large metal diaphragm which actuates the movement of a free-working member—no tight fitting guide. It is set to open at 28 pounds pressure making it suitable for 1, 2 or 3 story buildings. Adjustment up to 35 pounds may be made for individual special requirements. This valve is tested, approved and listed as standard by the Underwriters' Laboratories, complies with the A.

S. M. E. code requirements and is unconditionally guaranteed when properly installed.

Method of Operation—The valve is installed vertically, the water entering the valve at A, filling the entire valve chamber B to a level above the valve seat, which keeps it submerged. At top of water line a slight air cushion is present, which maintains a flexible pressure against diaphragm C. As pressure is built up against C, spring G is compressed until valve seat K lifts upwards off the seat when water passes through opening D and completely fills water seal E, follows opening F where overflow takes place.



It will be seen that valve seat K is completely submerged at all times, with no possibility of corrosion. The valve member has absolute freedom of action, cannot stick or fail to open.



PRESSURE REDUCING VALVE

Low Pressure Thrush Reducing Valves are pressure regulating valves for use with either water or air to maintain predetermined pressure automatically. The strainer is an integral part of each valve. Movement is actuated by flexible bronze metal diaphragms. These valves

are made in 5 sizes indicated as follows, No. 9— $\frac{1}{4}$ in., No. 9A— $\frac{3}{8}$ in., No. 10— $\frac{1}{2}$ in., No. 11— $\frac{1}{2}$ in. and No. 12— $\frac{3}{4}$ in. nominal pipe diameters. All working parts are red brass, and all housings are of brass except No. 12 which is cast iron. The standard pressure setting is 45 lbs. initial pressure, 12 lbs. delivery pressure, which is suitable for 1, 2 and 3 story buildings. If different pressures are desired—specify initial and delivery pressures. Nos. 10, 11 and 12 are designed for automatic filling and maintenance of proper water supply in a Hot Water Heating System. Every Thrush Low Pressure Reducing Valve is guaranteed against defects in material and workmanship.

STRAIGHT TUBE WATER HEATER

The straight tube construction eliminates scale formation. Straight tubes provide the largest amount of tube surface in the smallest space. It is easily accessible for inspection or cleaning through removable headers—if it ever requires cleaning. Made in sixteen sizes, for hot water or steam—high or low pressure.



of the Parts

FLOW CONTROL SYSTEM

RADIANT HEAT CONTROL

The No. 201 Thrush Radiant Heat Control (thermostat) entirely eliminates "cold 70." It automatically maintains room temperature within a fraction of a degree, controlling both room temperature and water temperature in the radiators. In addition it has a compensating feature to prevent variation in room temperature or a lack of radiant heat. Therefore it eliminates a common fault found in many ordinary room thermostats.

In addition to being a conventional thermostat, this Radiant Heat Control includes an element which is clamped to the return branch of the nearest radiator, and by this contact maintains water temperature in the radiators within a few degrees of the radiator temperature required to maintain the desired room temperature.

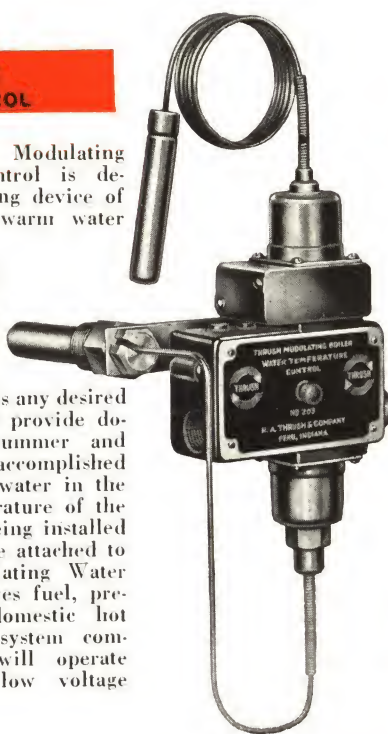
The No. 201 Thrush Radiant Heat Control is shipped complete with 35 ft. of two-wire cable, mounting screws and staples, clamp and two bolts and nuts for bulb, 20 ft. of flexible tubing, and complete installation instructions. Controls with extra length tubing net extra. Two wire low voltage control.



MODULATING WATER TEMPERATURE CONTROL

The No. 203 Thrush Modulating Water Temperature Control is designed to control the firing device of the automatically fired warm water heating system.

The unit automatically raises or lowers boiler water temperature to meet the demands placed on the heating system by changes of outdoor temperature. It also maintains any desired minimum temperature to provide domestic hot water in summer and winter. Operation is accomplished both by temperature of water in the flow riser and by temperature of the return main, one bulb being installed in the flow main and one attached to the return. The Modulating Water Temperature Control saves fuel, prevents overheating of domestic hot water and makes the system completely automatic. It will operate from either line or low voltage current.



PRESSURE TANK



All Thrush Systems are closed systems, using an air-tight Thrush Pressure Tank to provide for the expansion of water in

the boiler when heated. As the water expands into the tank, the air is compressed.

The tank is a vital part of the system as it conserves hot water and saves fuel. In the ordinary open gravity or tankless system, this water overflows and is wasted. Cold water must be added and of course it takes fuel to raise the temperature of the new water. With a Thrush Pressure Tank, water when expanded goes into the tank and is returned to the system when it cools.

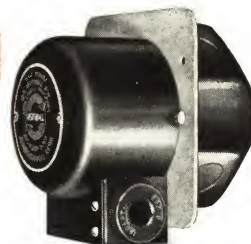
This tank also serves another important function. Air which would ordinarily get into the radiators and cause trouble in the system is diverted into this tank and held there to act as a cushion, keeping water in the system under continuous pressure.

Thrush tanks are made in four sizes that take care of systems up to 3,000 square feet of radiation. For larger jobs tanks of proper capacity are added.

RELAY TRANSFORMER

The Relay Transformer is used with the sensitive low voltage No. 201 Radiant Heat Control to furnish line voltage current to the circulator motor.

It is a simple, compact self-contained unit and includes a standard 4 in. junction box.



GAUGE AND THERMOMETER

A sensitive instrument for accurately indicating pressure, altitude and temperature of water in a hot water heating system. Stationary hands on face of gauge show proper filling point for 1, 2, 3, or 4 story building.



RELIEF VALVE No. 75

A good pressure relief valve is an absolute necessity with a domestic hot water supply system. The relief valve is made to protect hot water supply boilers, range boilers, gas storage heaters, etc., from excess pressure. They will positively prevent cracking or bursting of the boiler.

All Thrush relief valves are soundly engineered, have large water passages and are built without tight fitting working parts.

The angle type Thrush Relief Valve No. 75 illustrated at right is one of the best that can be bought. It is a safe and dependable pressure relief valve of the finest quality. The No. 75 is a gray iron valve 1/2 in. tapping, and has brass working parts, metal diaphragm and testing lever. Standard setting is for 85 lbs. pressure, though they can be adjusted at the factory for any pressure from 35 to 150 lbs. pressure. If other than the standard setting is desired it must be specified at time of ordering.

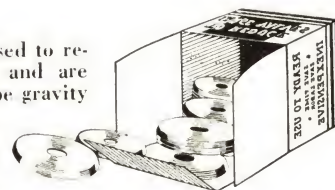


ORIFICE INSERTS

Thrush Orifice Inserts are used to reduce radiator valve openings and are designed for use in old, big pipe gravity jobs which are being converted to forced circulating systems. Large valves unbalance circulation and cause uneven heating of the radiators. Unusually large valve openings to hot water radiators also unbalance circulation and sometimes prevent other radiators from heating at all.

Thrush Orifice Inserts will insure substantially the same water temperature in every radiator. They are made of soft brass to fit the union connections of radiator valves or ells in six standard sizes—1/2 in., 3/4 in., 1 in., 1 1/4 in., 1 1/2 in. and 2 in., and will fit any make of radiator valve.

These Inserts are ready to use and easy to install.



Typical Installations

CONVERSION INSTALLATION

Having Two Flow and Return Mains

A Widely Used Installation

Average installation showing conventional method of main reduction in accordance with pipe size tables given on page 9. This can usually be accomplished with nipples and fittings, and minimum of pipe work and labor. In addition to main reductions, Thrush Orifice Inserts should be installed in radiator valves to balance flow through large branch connections.

STOKER FIRED INSTALLATION

That Insures Constant Room Temperature

Shows proper installation of Thrush Flow Control System with soft coal stoker fired boiler. Stoker is controlled by No. 203 Thrush Modulating Water Temperature Control G. The No. 206 Control J is wired to Thrush Circulator and will start Circulator if boiler temperature should override to 220 degrees. Will operate Circulator just long enough to reduce boiler temperature. If stoker does not have some form of draft control to reduce natural draft, then it is advisable to place a swing check damper in draft chamber ahead of blower. This will prevent high boiler temperature between stoker operations. The No. 201 Thrush Radiant Heat Control F operates Thrush Circulator only to maintain constant room temperature.

ZONE CONTROL INSTALLATION

Will Maintain Different Temperatures in Different Locations

Shows proper application of Thrush Flow Control equipment for two zone installation. A Thrush Flow Control Valve and Circulator, with separate No. 201 Thrush Radiant Heat Control, makes each zone a separate heating plant. Insures perfect temperature control to meet individual demand of each unit. Any desired temperature can be maintained in each zone, making it unnecessary to overheat one portion of a building in order to properly heat another part. Any number of zones can be heated from one boiler, eliminating the additional boilers that would be required to furnish individual heating for two or more tenants. Particularly recommended for apartments, row houses, or store buildings having several tenants.

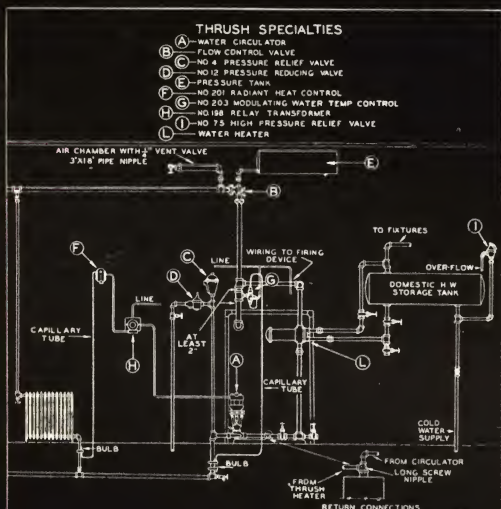
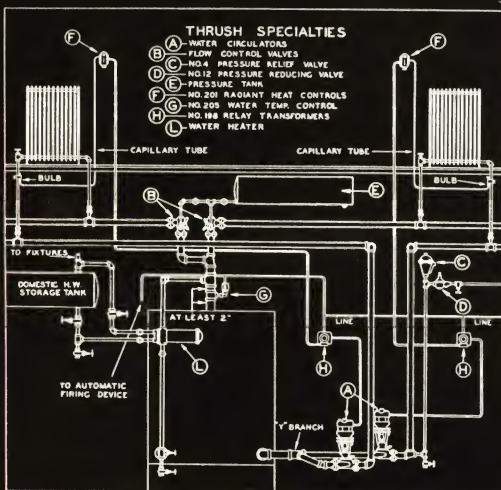
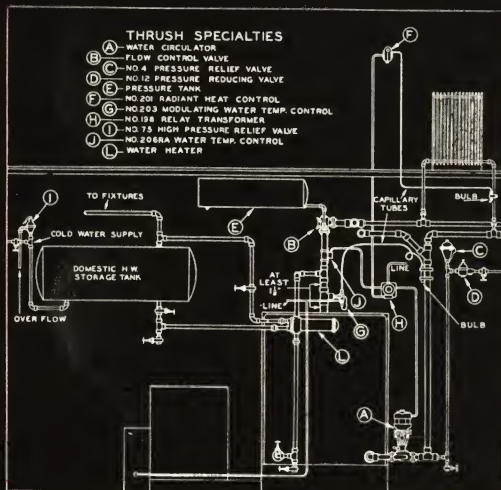
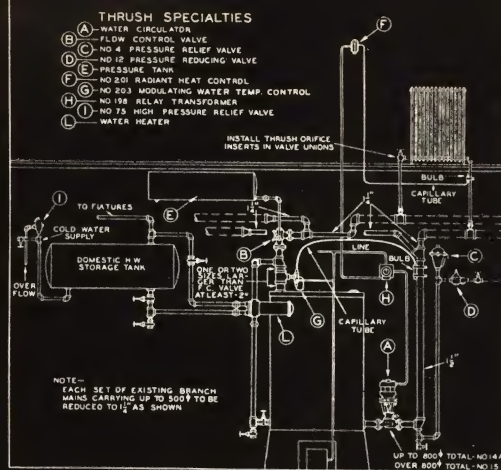
ARCOLA TYPE INSTALLATION

Where Flow Is Overhead and Return Under Floor

Shows correct installation of complete Thrush Flow Control System for Arcola type systems where flow main is carried overhead and return under floor.

Provides summer-winter domestic water supply and all the advantages of larger Flow Control installations.

Thrush Pressure Tank provides for expansion of boiler water. Air chamber is required to vent the flow main.



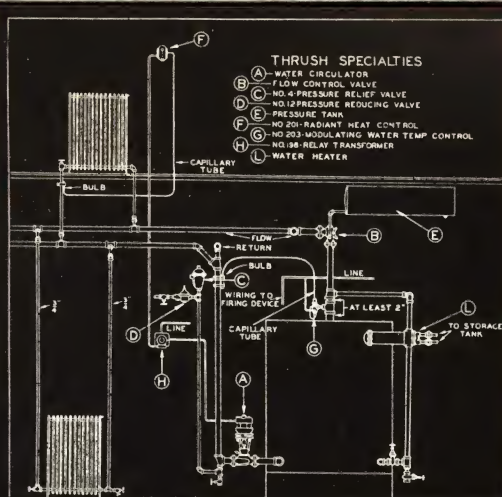
of THRUSH Systems

BASEMENT RADIATION INSTALLATION

Typical Installation With Connections for Radiator

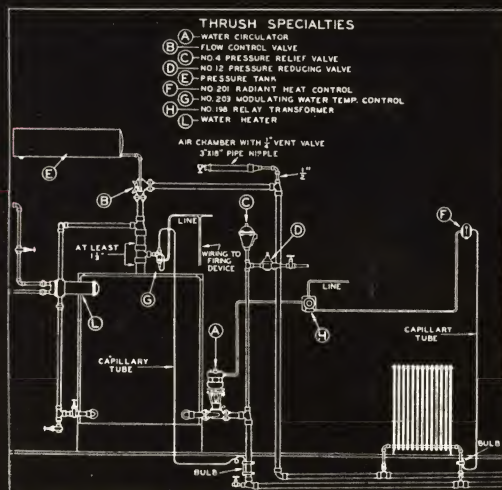
Saves Running a Separate Return

Shows method of circulating basement radiation with flow and return branches dropping down from mains on basement ceiling. Saves running separate return around wall at floor level. In buildings having no basement all of the radiators can be on the same level of the boiler and the flow and return mains carried above the radiators as shown. Domestic water connections are also shown.



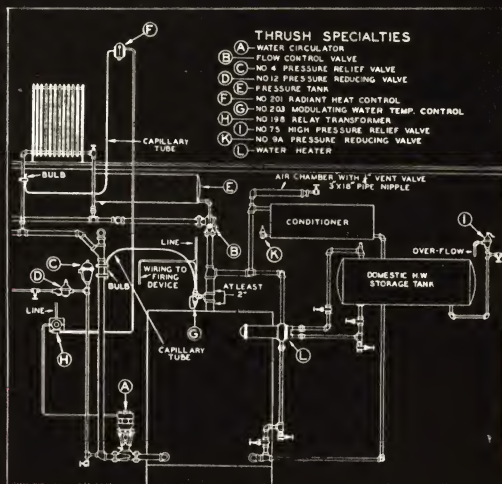
TYPICAL INSTALLATION FOR BUILDINGS WITHOUT BASEMENT

In localities where conditions prohibit excavating for basements, this detail shows how Thrush Flow Control System can be adapted. The boiler can be on the first floor level, or slightly lower, and both the flow and return mains carried under the first floor. Sizing of mains and branches is the same as for conventional system.



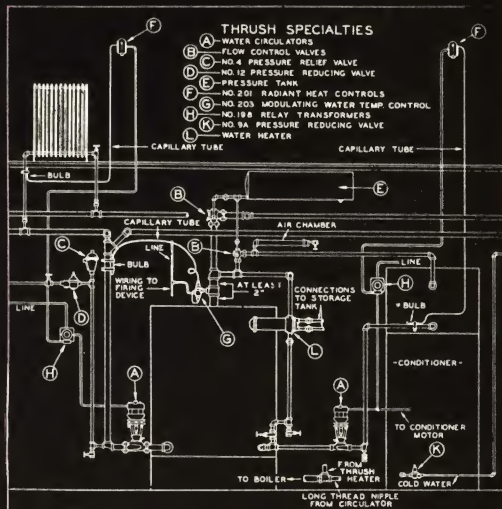
THRUSH FLOW CONTROL SYSTEM WITH WINTER CONDITIONER

This installation shows the complete Thrush Flow Control System in conjunction with a winter conditioner for cleaning and humidifying the air in living and sleeping rooms. The entire heating system is by hot water radiators sensitively controlled by the No. 201 Thrush Radiant Heat Control. Year around domestic water supply is also an additional advantage for this type of heating and conditioning system.



THRUSH FLOW CONTROL SYSTEM WITH SUMMER-WINTER CONDITIONER (Split System)

Where it is desired to heat as well as condition some rooms with the conditioner, this detail shows proper application of Thrush Flow Control System. It is not desirable to recirculate air from certain rooms (such as garages, servants' quarters, kitchens and baths). This installation provides zone control of the radiator system with the conditioner on a separate zone. Year around domestic water supply is an important feature of this system as shown. Thrush engineers recommend hot water heating for the entire building with air conditioning for part of the building, if desired.



The following B.t.u. method for figuring radiation is simple enough to be of practical value. Through the use of this method you will be assured that ample radiation is being provided. The tables give basic factors which can be used to accurately deter-

mine the amount of radiation or heat required to maintain any desired room temperature under practically all conditions. These tables are followed by an example which gives explanation for their use.

TABLES OF BASIC HEAT LOSS CO-EFFICIENTS

MASONRY WALLS									
Masonry Thickness (inches)	Type of Wall	Interior Finish							
		Plain	Plastered						
			No Finish	1/2" Thick	On Lath—furred	On 1/2" rigid ins.—furred	On 1" rigid ins.—furred	Lath—furred Alum. Foil	Lath—furred 1 1/2" ins. fill
8	Solid Brick	.50	.16	.32	.12	.16	.12	.12	.12
12	Brick	.36	.31	.25	.19	.14	.19	.11	.11
16	Brick	.28	.27	.21	.16	.13	.17	.10	.10
8	Hollow Tile	.40	.37	.27	.20	.15	.20	.11	.11
10	Stucco	.39	.37	.27	.19	.15	.20	.11	.11
12	Stucco	.30	.29	.22	.17	.13	.18	.10	.10
8	Limestone or Sandstone	.71	.64	.39	.25	.18	.26	.13	.13
12	Concrete	.58	.53	.34	.23	.17	.24	.13	.13
16	Concrete	.49	.45	.31	.22	.16	.20	.12	.12
6	Concrete	.79	.70	.42	.26	.19	.27	.13	.13
12	Concrete	.62	.57	.37	.24	.18	.25	.13	.13
16	Concrete	.48	.44	.31	.21	.16	.22	.12	.12
20	Concrete	.41	.39	.28	.20	.15	.21	.12	.12
8	Ginder Block	.42	.39	.28	.20	.16	.21	.11	.11
12	Block	.37	.35	.26	.19	.15	.19	.11	.11
8	Concrete Block	.56	.52	.34	.23	.17	.24	.12	.12
12	Block	.49	.46	.32	.22	.16	.23	.12	.12

MASONRY WALLS WITH VENEER									
Facing	Backing (inches)	Interior Finish							
		Plain	Plaster						
			No Finish	1/2" Thick	On Lath—furred	On 1/2" rigid ins.—furred	On 1" rigid ins.—furred	Lath—furred Alum. Foil	Lath—furred 1 1/2" ins. fill
4 in. Brick or Cut-Stone Veneer	6	.37	.33	.26	.19	.16	.19	.11	.11
	8	.36	.34	.25	.19	.14	.19	.11	.11
	10	.35	.33	.25	.18	.14	.19	.11	.11
	12	.28	.26	.21	.16	.13	.19	.10	.10
	6	.61	.56	.36	.24	.17	.24	.13	.13
	10	.51	.47	.32	.22	.16	.22	.12	.12
	16	.41	.38	.28	.20	.15	.20	.11	.11
	8	.35	.33	.25	.18	.14	.19	.11	.11
	12	.31	.30	.23	.17	.14	.18	.11	.11
	8	.44	.42	.30	.21	.16	.21	.12	.12
	12	.40	.38	.28	.20	.15	.20	.11	.11

PLASTERED FRAME WALLS WITH VARIOUS EXTERIORS									
Exterior Finish	Type of Wall	Sheathing Inches	Interior Finish						
			Studs and Lath	Interior Finish					
				Studs and 1/2 in. rigid insul.	Studs and 1 in. rigid insul.	Studs and Lath with insul. fill	Studs and Lath with Alum. Foil	Studs and Lath with Alum. Foil	Studs and Lath with Alum. Foil
Wood Siding or Shingles	Wood Rigid ins.	1/4	.30	.22	.17	.12	.25	.25	.25
Stucco	Wood Rigid ins.	3/4	.33	.25	.18	.13	.28	.28	.28
Brick Veneer	Wood Rigid ins.	3/4	.30	.22	.17	.12	.25	.25	.25

PARTITIONS			
Construction	Plain	Finished one side	Finished both sides
Studs, lath and plaster.....	.62	.34	.34
4 in. Clay Tile.....	.45	.42	.40
4 in. Gypsum Tile.....	.30	.28	.27
4 in. Clay Brick.....	.50	.46	.43

Concrete Floors and Ceilings					
Type of Ceiling	Inches Thick	Type of Finish Flooring			
		Bare	Wood on Sleepers	Tile or Terrazzo	Tile or Terrazzo
No Ceiling	4	.65	.40	.31	.61
	6	.59	.37	.30	.56
	8	.53	.35	.28	.51
Plaster direct to Concrete	4	.59	.38	.30	.56
	6	.54	.35	.28	.52
	8	.50	.33	.27	.47
Suspended Lath (or Plaster Bd.) & Plaster	4	.37	.28	.23	.36
	6	.35	.26	.22	.34
	8	.33	.25	.21	.32
Suspended 1/2 in. Rigid Insulation & Plaster	4	.24	.20	.17	.24
	6	.23	.19	.17	.23
	8	.22	.18	.16	.22
1 1/2 in. Corkboard & Plaster	4	.15	.13	.12	.14
	6	.14	.13	.12	.14
	8	.11	.12	.11	.14
No Ceiling Floor on Ground	4	1.07	.35	.28	.98
	6	.90	.33	.27	.84
	8	.79	.32	.26	.74



FRAME FLOOR AND CEILINGS				
Type of Ceiling	Type of Flooring			
	None	Pine	Pine on 1/2 in. Rigid Insul.	Maple or Oak on Pine
No Ceiling.....	.55	.32	.40	.40
Lath and Plaster or Plaster Bd.....	.73	.33	.28	.28
Lath, Plaster and 4 in. Rock Wool.....	.11	.10	.09	.09
1 1/2 in. Corkboard and Plaster.....	.19	.14	.13	.13

FLAT ROOFS														
Type of Roof Deck	No Ceiling							Lath (or Plaster Board) and Plaster Ceiling						
	Rigid Type Insulation							Rigid Type Insulation						
	No Insul.	1½ in. Fibre	1 in. Fibre	1 in. Cork	1½ in. Cork	2 in. Cork	No Insul.	1½ in. Fibre	1 in. Fibre	1 in. Cork	1½ in. Cork	2 in. Cork		
Concrete 2 in.	.32	.37	.24	.22	.16	.13	.42	.26	.19	.18	.14	.11		
Concrete 4 in.	.72	.34	.23	.21	.16	.12	.40	.25	.18	.17	.13	.11		
Concrete 6 in.	.61	.33	.22	.21	.15	.12	.37	.24	.18	.17	.13	.11		
Wood 1 in.	.49	.28	.20	.19	.14	.12	.32	.21	.16	.15	.12	.10		
Wood 1½ in.	.37	.24	.18	.17	.13	.11	.26	.19	.15	.14	.11	.10		
Wood 2 in.	.32	.22	.16	.16	.12	.10	.24	.17	.14	.13	.11	.09		
Flat Metal.	.95	.39	.25	.23	.17	.13	.46	.27	.19	.18	.14	.11		
Bare Cor. Iron.	1.50						1.10							

Plastered Ceilings with Unheated Attic, Shingles or Composition Roof on Wood Sheathing							
Insulation Between Ceiling Joists	Attic Finish						
	No Floor				1" Pine Floor		
	On lath (or Plaster Bd.)	On 1/2" Rigid Insul.	On 1" Rigid Insul.	On lath (or Plaster Bd.)	On 1/2" Rigid Insul.	On 1" Rigid Insul.	
None	.30	.22	.16	.21	.16	.12	
Alum. Foil	.23			.19			
1/2" Flexible	.20			.15			
1" Flexible	.16			.11			
3 1/2" Rock Wool	.11			.09			

Windows, Skylights and Doors			Air Changes in Room						
Single Windows or Skylights	Double Windows or Skylights	Doors	Changes per hour	1/2	1	1 1/2	2	3	4
1.35	.60	.69		.009	.018	.027	.036	.054	.072

AIR CHANGES TO BE USED UNDER NORMAL CONDITIONS

Type of Room or Building	Air Changes per Hour
Rooms having walls protected from outdoor air (basement rooms, etc.).....	1/2
Rooms having 1 side exposed.....	1
Rooms having 2 sides exposed.....	1 1/2
Rooms having 3 or 4 sides exposed, bathrooms, public rooms (stores, churches, etc.) and residence entrance halls.....	2
Entrance halls or lobbies to public buildings.....	3 or 4

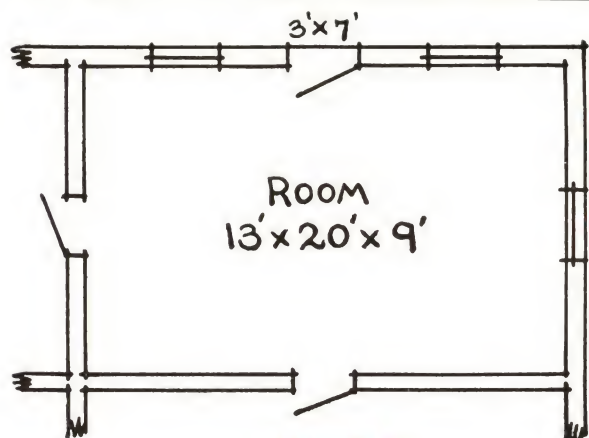
Add 1/2 air change to rooms on side or corner of prevailing wind and also those with fireplace.

OUTDOOR DESIGN TEMPERATURE

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RADIATOR HEAT EMISSIONS

Average Water Temp. in Radiators	Approximate Emission per Hour per Sq. Ft. of Direct Radiation
180° F.	170 B.t.u. (recommended for regular Thrush gravity systems).
190° F.	180 B.t.u.
200° F.	200 B.t.u. (recommended maximum for Thrush Flow Control Systems).



EXAMPLE

Maple Floor on pine sub-flooring with Basement under, no Basement ceiling.
Ceiling has attic space above with pitched roof and 1-in. pine floor.

FIRST

Determine B.t.u. or heat loss through all exposed or cold surfaces. **EXPOSED WALL:** There is a net surface of 231 sq. ft. and the basic heat loss factor for this construction will be found in the table to be .30 B.t.u. The room temperature to be maintained in this example is 70 deg. F. and the outdoor temperature zero, giving a temperature difference of 70 deg. Therefore 70 deg. x .30 B.t.u. per sq. ft. = 21 B.t.u.; 21 B.t.u. x 231 sq. ft. = 4851 B.t.u. loss per hour through exposed wall.

In like manner the loss through **WINDOWS, CEILING AND OUTSIDE DOOR** can be found. These losses will be found to be 4252 B.t.u., 3822 B.t.u. and 1014 B.t.u., respectively.

FLOOR LOSS: The basement under this floor is closed to the outside air and is partially heated by the mains so therefore assume its temperature to be 50 deg. in zero weather, making a temperature difference of 20 deg. between the two sides of floor. The basic heat loss factor for each degree of difference is .40 B.t.u. Therefore 20 deg. x .40 B.t.u. = 8 B.t.u.; 8 B.t.u. x 260 sq. ft. = 2080 B.t.u. required for floor.

SECOND

Determine B.t.u. required to heat air entering room by infiltration which results from chimney drafts, opening of doors, leakage through cracks, etc.

Cubical contents are 2340 cu. ft. and since the air in this room will change approximately $1\frac{1}{2}$ times each hour select the basic factor from the table which is .027 B.t.u. 70 deg. x .027 B.t.u. = 1.89 B.t.u.; 1.89 B.t.u. x 2340 cu. ft. = 4423 B.t.u. required for air entering room by infiltration.

THIRD

Determine the direct cast iron or equivalent radiation requirement for this room.

Take the total B.t.u. requirement found in the first and second steps of this example, which is 20,442 B.t.u. and divide same by any desired heat emission for each sq. ft. of radiating surface which will be found above this example. For regular Thrush Systems in which gravity or natural circulation is to be used, we would recommend a heat emission of 170 B.t.u. per sq. ft. $20,442 \div 170 = 120$ sq. ft. of radiation, or its equivalent required to heat this room. We would recommend a maximum heat emission of 200 B.t.u. for Thrush Flow Control and forced circulating systems which would make this room require 102 sq. ft.

In selecting an outdoor temperature to arrive at the required temperature it is not necessary to use the lowest outdoor temperature nor should the average winter temperature be used. A temperature of at least 40 deg. below the average winter temperature in or near your locality, taken from the Weather Bureau Records, is recommended.

Sizes

**RADIATOR VALVE AND RISER SIZES TO ALL FLOORS

	Steel Pipe
0—100 sq. ft. radiation.....	$1\frac{1}{2}$ "
over 100 sq. ft. radiation.....	$2\frac{1}{4}$ "
	Copper Pipe
0—60 sq. ft. radiation.....	$3\frac{1}{8}$ "
60—125 sq. ft. radiation.....	$1\frac{1}{2}$ "
over 125 sq. ft. radiation.....	$2\frac{1}{4}$ "

*Where $\frac{3}{8}$ " lateral branches are over average length, increase to $\frac{1}{2}$ " between mains and vertical risers.

**Down feed branches and valves, for radiators on basement floor, to be increased one size.

RISERS TO TWO OR MORE RADIATORS ON UPPER FLOORS

	Steel Pipe	Copper Pipe
0—75 sq. ft. total radiation.....	$1\frac{1}{2}$ "	$1\frac{1}{2}$ "
75—110 sq. ft. total radiation.....	$2\frac{1}{4}$ "	$1\frac{1}{2}$ "
over 110 sq. ft. total radiation.....	$3\frac{1}{4}$ "	$2\frac{1}{4}$ "

MAIN SIZES

STEEL PIPE	
Sq. Ft. of Radiation	Size and Number of Mains
0- 300	one 1"
301- 500	one $1\frac{1}{4}$ " or two 1"
501-1000	one $1\frac{1}{2}$ " or two $1\frac{1}{4}$ "
1001-1500	one 2" or two $1\frac{1}{2}$ "
1501-2500	one $2\frac{1}{2}$ " or two 2"
2501-5000	one 3" or two $2\frac{1}{2}$ "

$2\frac{1}{2}$ " and 3" mains may be reduced to 2" at proper radiation intervals.

COPPER PIPE	
Sq. Ft. of Radiation	Size and Number of Mains
0- 300	one $\frac{3}{4}$ ", over 50' long, 1"
301- 500	one 1" or two $\frac{3}{4}$ "
501- 800	one $1\frac{1}{4}$ " or two 1"
801-1250	one $1\frac{1}{2}$ " or two $1\frac{1}{4}$ "
1251-2000	one 2" or two $1\frac{1}{2}$ "
2001-3500	one $2\frac{1}{2}$ " or two 2"
3501-7000	one 3" or two $2\frac{1}{2}$ "

Mains smaller than 2" should be carried full size to terminating radiator, whether copper or steel pipe.

2", $2\frac{1}{2}$ ", and 3" mains may be reduced at proper radiation intervals to $1\frac{1}{2}$ ". Mains of unusual length or those meeting a special condition should receive special consideration.

B.T.U. HEAT EMISSION FACTORS

Per Square Foot per Hour for Various Average Water Radiator Temperatures

170 B.t.u.	for 180° F. average
180 B.t.u.	for 190° F. average
200 B.t.u.	for 200° F. average

It is reconciled as satisfactory in consideration of practical operation a maximum B.t.u. emission factor of 200 for calculations in Thrush Flow Control Systems.

Installation Data and Specifications

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FOR THRUSH FLOW CONTROL SYSTEM CONVERSION JOBS

Reduce flow and return mains at the boiler to same sizes as shown in tables, using reducing elbows or couplings and connect reduced return mains with Y fittings. Old jobs having $\frac{3}{4}$ in., 1 in., $1\frac{1}{4}$ in., $1\frac{1}{2}$ in., or 2 in. radiator valves should be reduced to proper sizes with Thrush Orifice Inserts.

Mains should terminate in first floor radiators where possible. Mains should pitch up from boiler to terminating radiator in the average upfeed installation.

Net boiler sizes should be determined from the total B.t.u. requirement, divided by 150, which is conventional method of boiler ratings. Boiler should be chosen on this basis of rating for standing radiation equivalent.

Specifications

SPECIFICATIONS FOR A THRUSH FLOW CONTROL HOT WATER HEATING SYSTEM

BOILER—Furnish and erect on substantial foundation having a guaranteed capacity of...sq. ft. radiation. Boiler to be supplied with drain cock and all the usual and necessary attachments and connections.

SMOKE FLUE—Owner to provide an adequate and properly located chimney flue of good draft and of sufficient area for use of boiler exclusively. If chimney or flue shall be found in any respect defective, owner shall make the necessary correction at his own expense.

SMOKE PIPE—Contractor will connect boiler to chimney with a galvanized iron pipe breeching of size not smaller than the smoke hood outlet at boiler.

HEATING SURFACE—The total heating surface to consist of...square feet of...radiation. Location of radiators to be arranged as best will suit the condition and space of each room and hall, and as owner or architect may direct. The distribution of radiation to conform to the schedule herewith attached. The radiators shall be the type as the owner or architect may determine.

RADIATOR VALVES AND AIR VALVES—Each radiator shall be fitted with one hot water radiator valve of the latest half-turn open and shut pattern, and an air valve of improved design, same to have detached key.

FLOOR AND CEILING PLATES—All pipes where they pass through floors and ceilings or walls will be supplied with neat, tight-fitting ceiling and floor plates.

PIPES AND FITTINGS—The supply and return piping will be of sizes necessary for easy and complete circulation. All pipes used for this work to be standard weight and sizes. Fittings to be of standard weight and free from imperfections.

HANGERS—Main pipes and principal branches in basement will be supported by hangers of neat design. Hangers to be of a type which will hold the pipe in perfect alignment and will permit of adjustment.

FLOW CONTROL VALVE SIZES

	Steel Pipe Sq. Ft. Rad.	Copper Pipe Sq. Ft. Rad.
No. 114—1"	Up to 300	Up to 500
No. 114A— $1\frac{1}{4}$ "	Up to 500	Up to 750
No. 115— $1\frac{1}{2}$ "	Up to 1,000	Up to 1,250
No. 120—2"	Up to 1,500	Up to 2,000
No. 125— $2\frac{1}{2}$ "	Up to 2,500	Up to 3,500
No. 130—3"	Up to 5,000	Up to 7,000

*CIRCULATOR SIZES FOR FLOW CONTROL

No. 11—1"	Up to 500 sq. ft. radiation
No. 11A— $1\frac{1}{4}$ "	Up to 800 sq. ft. radiation
No. 15— $1\frac{1}{2}$ "	Up to 1,500 sq. ft. radiation
No. 22—2"	Up to 2,500 sq. ft. radiation
No. 23—3"	Up to 5,000 sq. ft. radiation

*TANK SIZES FOR FLOW CONTROL SYSTEM

No. 0.	Up to 500 sq. ft. radiation
No. 1.	Up to 1,000 sq. ft. radiation
No. 2.	Up to 2,000 sq. ft. radiation
No. 3.	Up to 3,000 sq. ft. radiation

*Above sizes for 1 or 2 story buildings. Use one size larger tank for 3 or 4 story buildings.

†Capacities apply to average installations. Whenever mains are unusually long for their size or when some other special condition is to be overcome, increase circulator one size.

THRUSH FLOW CONTROL SYSTEM—Will furnish and properly install in basement Thrush Flow Control Hot Water Heating System, consisting of the following equipment: No. Thrush Water Circulator, No. Thrush Flow Control Valve, No. 4— $\frac{3}{4}$ " Thrush Differential Pressure Relief Valve, No. Thrush Pressure Tank, No. 12— $\frac{3}{4}$ " Thrush Pressure Reducing Valve, No. Thrush Water Heater, No. 201 Thrush Radiant Heat Control, No. 198 Thrush Relay Transformer, No. 203 Thrush Modulating Water Temperature Control, Thrush Combination Gauge and Thermometer, all of which will provide for the expansion of boiler water with summer and winter hook-up for the domestic hot water supply from the heating boiler without permitting circulation or expansion of the boiler water into the supply mains during the summer months, or when heat in the radiators is not required, with use of Thrush Flow Control Valve having air tapping provided underneath the seat of valve as means for expansion and air elimination.

DOMESTIC WATER SUPPLY—Will furnish and properly install attached to boiler indirect heater of proper size as manufactured by.....with suitable.....storage tank of.....gallons capacity, and necessary pipe and fittings together with one No. 75 Thrush Domestic Pressure Relief Valve to complete summer-winter domestic hot water supply.

PAINTINGS—Will paint radiators and all exposed pipes with first grade of materials and will paint all exposed pipes in the basement.

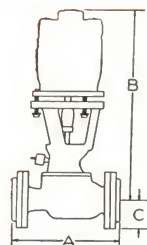
OWNER—Owners to provide boiler space to have all openings in buildings, i. e., windows, doors, etc., made reasonably tight, to prevent undue loss of heat.

GENERAL REQUIREMENTS—Contractors will cut all passages through the walls and through all floors and ceilings, and complete all and every part of said work required to make this apparatus in all of its parts complete in every detail. All work will be executed in the very best and substantial manner, equal in every respect to that which the best skilled mechanic can execute.

GUARANTEE—When this Thrush Flow Control System is complete.....guarantee it to be capable to maintain, in all rooms and halls where radiators are placed, a temperature ofdegrees Fahrenheit, when the outside temperature isdegrees.....zero.

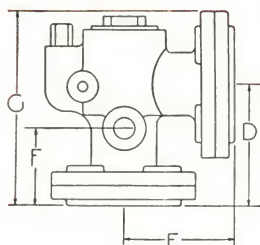
Thrush HOT WATER SPECIALTIES

ROUGHING-IN DIMENSIONS & WIRING DIAGRAM



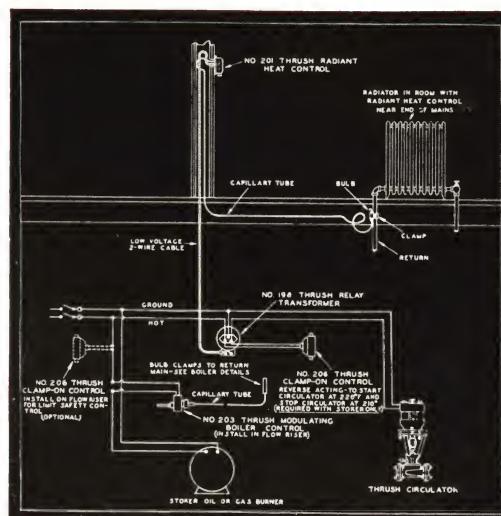
Thrush Water Circulator

Circulator		A	B	C
No.	Size, in.	In.	In.	In.
14	1	9 3/4	16 3/4	1 1/4
14A	1 1/4	10 1/2	16 3/4	1 1/2
15	1 1/2	10 1/8	16 1/4	1 3/8
22	2	10 1/8	18 3/4	2 3/8
23	3	11 3/8	20	3 3/8



Thrush Flow Control Valve

Flow Control Valve		D	E	F	G
No.	Size, in.	In.	In.	In.	Overall, in.
114	1	2 1/8	2	1	4 1/8
114A	1 1/4	4 1/8	3 3/4	2 3/4	6 3/8
115	1 1/2	4 3/8	4 1/8	3 1/8	6 7/8
120	2	4 3/4	4 1/8	3 1/8	7 3/8
125	2 1/2	5 1/4	4 3/8	3 1/4	8 1/4
130	3	6 1/2	5 7/8	3 3/8	9 3/4



COMBINATION HIGH PRESSURE AND TEMPERATURE RELIEF VALVES

No.	Size	Made of	Weight
76	1 1/2"	Iron	3 lbs.
78	2"	Brass	3 lbs.
87	3/4"	Iron	4 lbs.
89	3/4"	Brass	4 lbs.

Similar in construction and for same purposes as high pressure relief valves, but with additional feature—temperature relief. A fusible plug melts from excessive temperature. Can be furnished from factory set at any pressure up to 150 lbs. Standard setting 85 lbs. Specify when ordering if other than 85 lbs. setting required.

THRUSH LOW PRESSURE (See No. 30) Relief Valves

Thrush Relief Valves for hot water heating plants are made in a range of types, sizes, and prices, to meet varying conditions. All have all-brass working parts and can be supplied from the factory set for any relief pressure up to 35 lbs. The standard relief setting is 28 lbs.

No.	Size	Made of	Weight
4	3/4"	Iron	12 lbs.
30	1 1/2"	Iron	4 lbs.
35	1 1/2"	Brass	3 lbs.
40	1 1/2"	Iron	3 lbs.

Reducing Valves

Pressure regulating valves to maintain predetermined pressure automatically. All working parts are brass. Bronze metal diaphragm operated. Standard factory pressure setting for delivery pressure of 12 lbs., with an initial pressure of 45 lbs. Specify when ordering if different pressure setting desired.

No.	Size	Made of	Weight
9	1 1/4"	Brass	2 lbs.
9A	3/8"	Brass	2 lbs.
10	1 1/2"	Brass	4 lbs.
11	1 1/2"	Brass	5 lbs.
12	3/4"	Iron	7 lbs.

THRUSH HIGH PRESSURE (See No. 75) Relief Valves

All are metal diaphragm operated Relief Valves with all-brass working parts, soundly designed to protect safely hot water supply boilers, range boilers, and gas storage heaters. Can be supplied from factory set at any pressure up to 150 lbs. Standard setting 85 lbs. Specify when ordering if other than 85 lbs. pressure setting required.

No.	Size	Made of	Weight
45	1 1/2"	Iron	3 lbs.
75	1 1/2"	Iron	3 lbs.
77	1 1/2"	Brass	3 lbs.
55	1 1/2"	Iron	4 lbs.
85	3/4"	Iron	4 lbs.
86	3/4"	Iron	4 lbs.
88	3/4"	Brass	4 lbs.

THRUSH DUAL CONTROL UNITS

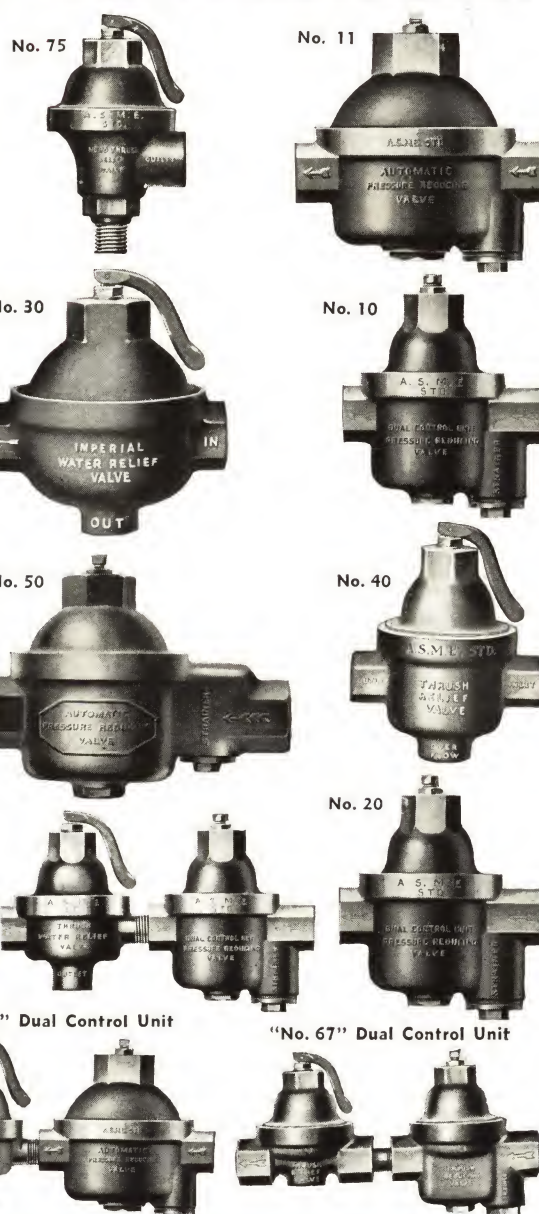
Thrush Dual Control Units are made in three types. Standard and Master are constructed of brass, and No. 67 has brass working parts with cast iron housing.

These Units fill the system automatically with the proper amount of water, also automatically relieve excessive pressure. All are equipped with built-in strainer and are guaranteed against defects in workmanship and material.

The Master Unit is bigger and has larger waterways for quicker filling.

For more efficient operation install a Thrush Pressure Tank in conjunction with a Thrush Dual Unit.

All Thrush relief valves comply with A.S.M.E. code requirements and are tested, approved and listed as standard by Underwriters Laboratories, Inc.



Thrush



HOT WATER
HEATING SYSTEM
FLOW CONTROL

H. A. THRUSH & CO., PERU, IND.

